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Nematodes in the Home Garden

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Introduction

Nematodes are common soil pests that affect plants. The aboveground symptoms of disease caused by nematodes can be difficult to detect, and may be often confused with symptoms of nutrient deficiency. Typically, plants do not thrive, are paler than normal, and may wilt in the heat of the day. Affected plants are often dwarfed, with small leaves. Sometimes, when infected plants are growing in moist, fertile soil, or during cool weather, the aboveground parts can still appear healthy.

Types of nematodes

There are numerous soil-inhabiting nematode species, but not all are harmful to plants. This Gardennote deals only with plant-parasitic nematodes. Within this group, some nematodes spend their life within the plant roots. These are endoparasitic. Others are ectoparasitic, and only their stylets (hollow spears used to puncture roots) enter the plant to extract nutrients from the roots or root cells. Plant-parasitic nematodes have many hosts and are seldom plant-specific.

Figure 1: Plant parasitic nematode (approximately 0.5 mm long)

Root knot nematodes (RKN)

Root knot nematodes (*Meloidogyne*) are the most damaging species in the home garden. These nematodes have a very wide host range, affecting more than 2000 plant species worldwide. RKN enter the roots as larvae, causing the plant roots to form galls or knots, and there may be excessive root branching. Underground organs such as potato tubers or carrot taproots may be damaged and become unmarketable. The nematode larvae mature in the roots, where they mate. The female adults enlarge, remain in the roots, and lay eggs into an egg sac that exudes into the soil. The eggs hatch and the young larvae go on to infect more roots.

Plants are damaged because the galls or root knots block the transport of water and nutrients through the plant. Nematode feeding sites in the roots can also provide entrance for other disease-causing organisms (such as fungi or bacteria), leading to increased plant damage. Nematodes are a greater problem where conditions favour them, such as a long growing season, sandy soil and if plants are under stress (such as water or nutrient stresses).

Figure 2: Tomato roots with galls produced by root knot nematodes

Figure 3: Poor growth and decline of grape vine due to root knot nematodes

Root lesion nematodes (RLN)

Although they are present in home gardens (where they can affect fruit trees, roses and turf), root lesion nematodes (*Pratylenchus*) are more damaging to broad-acre crops such as cereals. RLN use the stylet to puncture roots and enter the cells. They move through the root, piercing cells, extracting cell contents, and leaving behind a trail of both cell-killing metabolites and eggs. Root cell death results in browning and lesioning of the roots. These lesions can rapidly coalesce to result in browning of whole roots. Individual lesions may fully encircle a root. RLN also damage feeder roots and root hairs, further reducing a plant's effective extraction of water and nutrients from the soil. The overall effect is a weak, shallow root system with many dead or dying areas. When the soil dries out, root lesion nematodes become inactive and survive in a dry form in the soil or in root tissue of old crops. As the soil moistens, the nematodes become active again and reinfect the fresh roots of the new crop.

Cause

Many nematodes occur naturally, at low levels, in most soils. Most plant-parasitic nematodes enter the garden through infested soil or infested transplants. Once nematodes are present, they are almost impossible to eliminate, but their damage to plants can be reduced. Inspect the roots of transplants before placing them into your garden, whether they originate from a reputable dealer or a neighbour. This will help to keep your garden clean. Successive growth of plants that host the nematodes will lead to an increase in their population.

Control

Chemical

Nematicides available to the home gardener come in granulated form and are highly toxic. Because registrations constantly change, this Gardennote does not recommend specific chemicals. Consult your local plant nursery or chemical reseller on registered chemicals to control nematodes in the home garden. Strictly follow label recommendations when applying these chemicals. Because of the high toxicity of these chemicals, most gardeners would not choose a nematicide for home use, so it is important to prevent the introduction of plant-parasitic nematodes, or to maintain low nematode levels and reduce the damage caused to plants.

Cultural

There are a number of cultural practices which can be used should nematodes become a problem. These practices are aimed at reducing the nematode population by cutting off their food supply, disturbing their breeding ground and changing their habitat.

Crop rotation

By rotating the most susceptible crops (like tomato, bean, capsicum, carrot, and eggplant) with less susceptible crops (like globe or Jerusalem artichoke, asparagus, sweet corn, broccoli, Brussels sprouts and mustard), nematode populations in the soil can be reduced to levels that will be less damaging to subsequent plants grown in the same area. Plants of the same family and root crops should be avoided in consecutive years.

Relocation of your garden

Relocation of your garden may be an easy solution, provided space is available. Be aware that moving the garden to a new site does not ensure complete escape from plant-parasitic nematodes: they may be present in previously unplanted areas because they can also survive on the roots of certain weeds and woody plants. Do not continue to grow plants susceptible to nematodes in an area with a history of nematode problems.

Resistant varieties

Many nematode-resistant plant varieties are now available. Check seed catalogues for resistant varieties, but be aware that you need to know which types of nematodes are present, as plant varieties may only be resistant to certain types. The most common garden nematodes are root knot nematodes.

Early-season cropping

Some vegetables (lettuce, onion, radish, leafy greens, green pea, bean, or brassicas) can be planted early and escape serious nematode damage. These plants grow when temperatures are cooler, and nematode reproduction and activity are reduced. These plants are also harvested before nematode damage becomes serious. Nematode damage can be most severe in late-season plantings.

Root destruction

As nematodes continue to feed on and reproduce in root fragments in the soil, it is a good move to destroy and remove the crop roots as soon as the plants are harvested. This should diminish the population before the next crop is planted. Regrettably, this will also reduce the useful organic matter content of the soil.

Organic matter

Increased water and nutrients help plants to tolerate nematode attack. It is therefore useful to increase the soil organic matter, which helps to retain moisture and adds to the available plant nutrients. Peat, manure, or compost all will hasten the decay of organic matter, and release nutrients through microbial action. The increased level of microbes in the soil favours the build-up of organisms that feed on other soil microbes, including nematodes. When adding compost, take care that the compost does not include partially decomposed roots containing plant-parasitic nematodes or other soil-borne pathogens.

So-called green manure crops such as legumes, clover, vetch, or rye can also build up organic matter in the soil. These crops are planted in autumn and tilled into the soil in early spring, giving enough time for decomposition before the next crop is planted. Some evidence suggests that the incorporation of a green manure crop produces compounds that are toxic to nematodes. This is especially true for green, leafy brassicas. The soil disturbance occurring with this incorporation can also reduce the nematode levels.

Soil solarisation

High temperatures can help to control nematodes and some other plant diseases which carry over in the soil. You can treat sections of garden beds by raking out any plant remains, moistening and smoothing the soil surface, then laying and firmly pegging down a sheet of thin clear plastic. Leave this in place for at least a month during mid-summer. The sun's heat will penetrate deep into the soil, killing many unwanted organisms. To be effective, the soil temperature should reach 37 to 52°C for several months.

Soil analysis

A nematode count, combined with identification of the nematode species present, is the most accurate way to diagnose a nematode problem. Soil samples should be taken before the crop is planted. The area should be sampled on a grid, and the sub-samples mixed gently in a container. Each sub-sample should represent the upper 20 cm of soil. From this mixture, remove about 500 g of soil and seal it in a plastic bag for submission to the:

Pest and Disease Information Service
3 Baron Hay Court
South Perth WA 6151
Phone: 1800 084 881
Email: info@agric.wa.gov.au

An analysis will be performed, and the results interpreted by an expert adviser. There may be a charge for this service. The Pest and Disease Information Service will be able to provide details. Plant roots can also be investigated for symptoms of nematode infestation, which is useful when planning future plantings in a nematode-infested area.

Exotic nematode species

There are currently two major nematode species of quarantine concern to Western Australia: the potato cyst nematode and the stem and bulb nematode.

Potato cyst nematode (PCN)

There are several types of cyst-forming nematode, but *Globodera rostochiensis* poses a threat to the Western Australian potato industry. PCN has been identified in isolated areas of some Australian potato fields. PCN has the potential to cause significant damage to the Australian potato industry through crop losses and the loss of export markets. The main crops affected by PCN are potato, eggplant, and tomato.

PCN cysts can remain dormant in the soil for up to 30 years. A cyst is the dead body of the female, and may contain up to 500 eggs. Means of dispersal or introduction are through infested soil adhering to machinery, shoes or on plant roots. PCN could also be introduced from infected seed potatoes or tubers. A diagnostic symptom of PCN is the appearance of round, pinhead-sized cysts on potato roots around the time of flowering. The female nematodes are white when alive, but turn yellow to golden to brown as the cyst matures. Infection does not cause roots to form galls as with RKN. In heavily infested soils plants have reduced root systems, develop nutrient deficiencies and consequently

Figure 4: Cyst nematodes. White pinhead-sized females develop on the roots, then turn brown to golden

display poor growth and wilting. Symptomatic plants are usually patchy within a field due to uneven distribution of the nematodes. Affected plants are more susceptible to infection by fungal pathogens and may age prematurely.

Stem and bulb nematode

This is more a pest of broad-acre crops, and currently occurs in Victoria and South Australia. This nematode would be a serious threat to agricultural production if introduced to Western Australia. Stem nematodes (*Ditylenchus*) attack the crown or stem base of susceptible crops like oat, faba bean, field pea, lentil, or canola. Symptoms include poor emergence, stunting, swollen stem bases, and yellow or brown streaks on leaves. These nematodes could be introduced through infected seed, bulbs, or soil.

Caution

It important not to introduce any seeds or plant material from interstate or overseas unless proper channels have been used and they meet with quarantine guidelines. Unless in advanced stages, nematodes are very hard to detect visually.

If exotic nematodes are suspected please phone the Pest and Disease Information Service on 1800 084 881.

Reference:

Donald, P. (1998). *Managing Nematodes in Gardens*. Agricultural publication G6204: Department of Plant Pathology, Plant Science Unit, University of Missouri-Columbia.

Table 1. Nematodes that can affect plants in the home garden

Common name	Scientific name	Visible diagnostic symptoms	Plants affected	Garden plants that may be affected
Root knot nematode (RKN)	*Meloidogyne* (several species)	Stunting, galling and knotting of roots	Numerous horticultural and ornamental crops	Almond Brassica (broccoli, cabbage, cauliflower, turnip) Capsicum Carnation Carrot Celery Cucurbits (cucumber, squash, zucchini, melon) Eggplant French bean Grape Lettuce Passionfruit Peach Rhubarb Rose Strawberry Sweet corn Tomato Potato
Root lesion nematode (RLN)	*Pratylenchus* (several species)	Lesioning and discolouration of roots, destruction of feeder roots, stunted and shallow root system	Numerous crops	Apple Carrot Citrus Grape Peach Pear Potato Rose Strawberry Turf
*Potato cyst nematode (PCN)	*Globodera rostochiensis*	Cysts (white turning yellow to golden brown) on root surfaces, yellowing, wilting, small tubers, reduced root system, premature plant death	Solanaceous crops	Potato Tomato Eggplant
*Stem and bulb nematode	*Ditylenchus dipsaci*	Leaf distortion, swelling of plant crowns, discolouration of bulbs		Ornamental bulbs Onion Garlic Pea Broad bean

* Exotic nematode species of quarantine concern to Western Australia

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